

CLAIMS:

1. A sulfate process for producing titania from a titaniferous material which includes the steps of:

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- (a) leaching the titaniferous material with a leach solution containing sulfuric acid and forming a leach liquor that includes an acidic solution of titanyl sulfate (TiOSO_4)
- 10 and iron sulfate (FeSO_4);
- (b) separating the leach liquor and a residual solid phase from the leach step (a);
- 15 (c) precipitating iron sulfate from the leach liquor from step (b) and separating precipitated iron sulfate from the leach liquor;
- 20 (d) extracting titanyl sulfate from the leach liquor from step (c) with a suitable solvent and thereafter stripping titanyl sulfate from the solvent and forming a solution that contains titanyl sulfate;
- 25 (e) using at least part of a raffinate from solvent extraction step (d) as at least part of the leach solution in the leach step (a);
- 30 (f) hydrolysing the solution that contains titanyl sulfate and forming hydrated titanium oxides from the titanyl sulfate;
- 35 (g) separating a solid phase containing hydrated titanium oxides and a liquid phase that are produced in the hydrolysis step

(f); and

(h) calcining the solid phase from step (g) and forming titania.

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2. The process defined in claim 1 further includes a further leach step of leaching the residual solid phase from step (b) with a leach solution containing sulfuric acid and forming a leach liquor that includes an acidic solution of titanyl sulfate and iron sulfate and a residual solid phase.

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3. The process defined in claim 2 includes carrying out the leach step (a) and the further leach step in the same vessel.

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4. The process defined in claim 3 wherein the further leach step includes returning the residual solid phase from step (b) to the vessel.

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5. The process defined in claim 4 includes carrying out the leach step (a) and the further leach step in separate vessels and supplying the residual solid phase from the leach step (a) to the separate vessel or vessels.

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6. The process defined in claim 5 wherein the further leach step includes separating the leach liquor and a further residual solid phase formed in the further leach step.

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7. The process defined in claim 6 further includes supplying the separated leach liquor to the leach step (a) or mixing the separated leach liquor with the leach liquor from step (b).

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8. The process defined in any one of claims 2 to 7 wherein step (e) includes using at least part of the

raffinate from solvent extraction step (d) as at least part of the leach solution in the further leach step.

9. The process defined in any one of the preceding
5 claims wherein the leach step (a) and/or the further leach
step includes selecting and/or controlling the leach
conditions in the leach step or steps to avoid undesirable
amounts of premature hydrolysis of hydrated titanium
oxides and undesirable amounts of premature precipitation
10 of titanyl sulfate.

10. The process defined in claim 9 wherein the leach
conditions include any one or more than one of acid
concentration, leach temperature and leach time.

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11. The process defined in claim 9 or claim 10
includes selecting and/or controlling the acid
concentration to be at least 350 g/l sulfuric acid
throughout the leach step (a) and/or the further leach
20 step when operating at a leach temperature in the range of
95°C to the boiling point in order to avoid premature
hydrolysis.

12. The process defined in any one of claims 9 to 11
25 includes selecting and/or controlling the acid
concentration to be less than 450 g/l at the end of the
leach step (a) and/or the further leach step when
operating at a leach temperature in the range of 95°C to
the boiling point in order to avoid an undesirable amount
30 of premature precipitation of titanyl sulfate.

13. The process defined in any one of claims 9 to 12
includes the selecting and/or controlling the leach
conditions so that the titanium ion concentration in the
35 leach liquor is less than 50 g/l in the leach liquor at
the end of the leach step (a) and/or the further leach
step.

14. The process defined in any one of the preceding claims wherein the raffinate from the solvent extraction step (c) has an acid concentration of at least 250 g/l
5 sulfuric acid.

15. The process defined in any one of the preceding claims includes carrying out the leach step (a) and/or the further leach step in the presence of an additive that
10 accelerates the rate of leaching the titaniferous material.

16. The process defined in claim 13 wherein the leaching accelerant is selected from the group that
15 includes iron, a titanium (III) salt, a thiosulfate salt, sulfur dioxide or any other reduced sulfur containing species.

17. The process defined in any one of the preceding claims includes carrying out the leach step (a) and/or the further leach step in the presence of a reductant that
20 reduces ferric ions to ferrous ions in the acidic solution or solutions of titanyl sulfate and iron sulfate produced in the leach step (a) and/or the further leach step.

25 18. The process defined in claims 17 wherein the reductant is selected from the group that includes iron, a titanium (III) salt, a thiosulfate salt, sulfur dioxide or any other reduced sulfur containing species.

30 19. The process defined in any one of the preceding claims wherein the solvent extraction step (d) includes contacting the leach liquor with the selected solvent and a modifier.

35 20. The process defined in any one of the preceding claims further includes controlling the hydrolysis step

(e) to produce a selected particle size distribution of the hydrated titanium oxides product.